

NAME SERVICE IN A SERVICE-ORIENTED GAMING NETWORK ENVIRONMENT

Cross-reference to Related Applications

5 This application claims the benefit of United States Provisional Patent Application serial no. 60/455,406, entitled "NAME SERVICE IN A SERVICE-ORIENTED GAMING NETWORK ENVIRONMENT", filed March 17, 2003; and is related to United States Patent Application serial no. 10/788903, entitled "A SERVICE-ORIENTED GAMING NETWORK ENVIRONMENT", (Attorney Docket 1842.020US1), filed on February 26, 2004 and
10 assigned to the same assignee as the present application; each of which are hereby incorporated by reference herein for all purposes.

Field

 The present invention relates generally to software and hardware systems for gaming
15 machines and gaming machine networks, and more particularly to providing a name service in a service-oriented gaming network environment.

Background

 Today's gaming terminal typically comprises a computerized system controlling a
20 video display or reels that provide wagering games such as video and mechanical slots, video card games (poker, blackjack etc.), video keno, video bingo, video pachinko and other games typical in the gaming industry. In addition, support computing systems such as accounting, player tracking and other "back office" systems exist in order to provide support for a gaming environment.

25 In order to prevent players from becoming bored, new versions of wagering games, and alterations to existing games are constantly being developed. In the past, the game software and content for gaming terminals and back office systems have been developed using proprietary or closed hardware, operating systems, application development systems, and communications systems. Sometimes these systems are provided by a single vendor.

Unfortunately, due to the proprietary and closed nature of existing architectures, it can be difficult to develop new games, and it is difficult to add games to existing proprietary game architectures. As a result, the cost and time associated with updating and adding new games to gaming networks is relatively high.

5 Additionally, game architectures that exist on gaming networks typically require the ability to identify devices and services on the network. However, identification schemes in proprietary architectures typically do not interact with schemes designed for different proprietary architectures. Further, new services and devices introduced into gaming networks may require additional flexibility in name and identification schemes.

10 In view of the above-mentioned problems and concerns, there is a need in the art for the present invention.

Summary

15 The above-mentioned shortcomings, disadvantages and problems are addressed by the present invention, which will be understood by reading and studying the following specification.

 One aspect of the systems and methods relates to providing a name service in a gaming network. The gaming network may comprise gaming machines, service providers, and other entities. The entities participating in the gaming network may implement a Gaming Services Framework using the World Wide Web and internetworking technology. The World Wide Web ("Web" from here on) is a networked information system comprising agents (clients, servers, and other programs) that exchange information. The Web and networking architecture is the set of rules that agents in the system follow, resulting in a shared information space that scales well and behaves predictably.

25 The Gaming Services Framework comprises a set of services, protocols, XML schemas, and methods for providing secure gaming system functionality in a distributed, network based architecture. It is intended to be a service-oriented framework for gaming and property management based upon internetworking technology and web services concepts. Specifically, it supports a loosely coupled architecture that consists of software components

that semantically encapsulate discrete functionality (self contained and perform a single function or a related group of functions – the component describes its own inputs and outputs in a way that other software can determine what it does, how to invoke its functionality, and what result to expect). These components are distributed and programmatically accessible
5 (called by and exchange data with other software) over standard internetworking protocols (TCP/IP, HTTP, DNS, DHCP, etc.).

The present invention describes systems, methods, and computer-readable media of varying scope. In addition to the aspects and advantages of the present invention described in this summary, further aspects and advantages of the invention will become apparent by
10 reference to the drawings and by reading the detailed description that follows.

Brief Description Of The Drawings

FIG. 1 is a perspective view of an exemplary gaming machine incorporated in the present invention.

15 FIG. 2 is a block diagram providing an example of a service-oriented network for distributed management in a gaming environment.

FIG. 3 is a block diagram providing general description of service-oriented discovery and interaction.

FIG. 4 is a representation of a Gaming Services Protocol Stack according to embodiments of
20 the invention.

FIGs. 5A and 5B are flow diagrams illustrating methods and message flow for a providing a name service according to embodiments of the invention.

Detailed Description

25 In the following detailed description of exemplary embodiments of the invention, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific exemplary embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized

and that logical, mechanical, electrical and other changes may be made without departing from the scope of the present invention.

Some portions of the detailed descriptions which follow are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the ways used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, terms such as “processing” or “computing” or “calculating” or “determining” or “displaying” or the like, refer to the action and processes of a computer system, or similar computing device, that manipulates and transforms data represented as physical (e.g., electronic) quantities within the computer system’s registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

In the Figures, the same reference number is used throughout to refer to an identical component which appears in multiple Figures. Signals and connections may be referred to by the same reference number or label, and the actual meaning will be clear from its use in the context of the description.

The description of the various embodiments is to be construed as exemplary only and does not describe every possible instance of the invention. Numerous alternatives could be implemented, using combinations of current or future technologies, which would still fall within the scope of the claims. The present invention is directed to a service-oriented

framework for gaming networks that allows for the interoperability of the software components (regardless of manufacturer, operating system, or application) reducing the dependence on a closed-system, single vendor solutions and allowing for variety in innovation and competition.

5 The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

Operating Environment

FIG. 1 illustrates an exemplary gaming machine 10 in which embodiments of the invention may be implemented. In some embodiments, gaming machine 10 is operable to conduct a wagering game. These wagering games may include reel based games such as video or mechanical slot machine games, card based games such as video poker, video dice games (e.g. a Yahtzee® like dice game) or other types of wagering games typical in the gaming industry. If based in video, the gaming machine 10 includes a video display 12 such as
10 a cathode ray tube (CRT), liquid crystal display (LCD), plasma, or other type of video display known in the art. A touch screen preferably overlies the display 12. In the illustrated embodiment, the gaming machine 10 is an "upright" version in which the display 12 is oriented vertically relative to a player. Alternatively, the gaming machine may be a "slant-top" version in which the display 12 is slanted at about a thirty-degree angle toward the player.
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20 The gaming machine 10 includes a plurality of possible credit receiving mechanisms 14 for receiving credits to be used for placing wagers in the game. The credit receiving mechanisms 14 may, for example, include a coin acceptor, a bill acceptor, a ticket reader, and a card reader. The bill acceptor and the ticket reader may be combined into a single unit. The card reader may, for example, accept magnetic cards and smart (chip) cards coded with money
25 or designating an account containing money.

In some embodiments, the gaming machine 10 includes a user interface comprising a plurality of push-buttons 16, the above-noted touch screen, and other possible devices. The plurality of push-buttons 16 may, for example, include one or more "bet" buttons for wagering, a "play" button for commencing play, a "collect" button for cashing out, a help"

button for viewing a help screen, a "pay table" button for viewing the pay table(s), and a "call attendant" button for calling an attendant. Additional game specific buttons may be provided to facilitate play of the specific game executed on the machine. The touch screen may define touch keys for implementing many of the same functions as the push-buttons. Additionally, in
5 the case of video poker, the touch screen may implement a card identification function to indicate which cards a player desires to keep for the next round. Other possible user interface devices include a keyboard and a pointing device such as a mouse or trackball.

A processor controls operation of the gaming machine 10. In response to receiving a wager and a command to initiate play, the processor randomly selects a game outcome from a
10 plurality of possible outcomes and causes the display 12 to depict indicia representative of the selected game outcome. In the case of slots for example mechanical or simulated slot reels are rotated and stopped to place symbols on the reels in visual association with one or more pay lines. If the selected outcome is one of the winning outcomes defined by a pay table, the processor awards the player with a number of credits associated with the winning outcome.

FIG. 2 illustrates an example of a Gaming Service Network 210 comprising a
15 customer data center 218 and a customer property 216. The data center 218 and customer property 216 are connected via a network 220. In some embodiments, network 220 is a public network such as the Internet. However, in alternative embodiments, private networks, including corporate intranets or extranets may be used to connect a data center 218 with one
20 or more properties 216.

In some embodiments, the Customer Corporate Data Center 218 contains the bulk of the network servers supporting gaming properties owned by the corporation. Major elements of the gaming service network include Auth server 232, Gaming Management Server 236, and Progressive Server 238. In some embodiments, Auth Server 32 provides authentication,
25 authorization and content integrity for client devices attempting to interact with other servers and services in the architecture.

In some embodiments, the Gaming Management Server 236 includes the following services: Boot Service, Name Service, Time Service, Game Management Service, Game Update Service, Event Management Service, Accounting Service, and Discovery Service.

In some embodiments, the Progressive Server 238 hosts a value-add service that allows a gaming machine to participate within a progressive gaming offering. Any value-add service can be added or substituted for this server/service. A progressive game offering is provided as an example. Other value-add services can be distributed on existing servers or
5 reside on a newly added server.

The Customer Property 16 contains gaming machines 10, which in some embodiments allow remote updates and configuration through a network interface on the gaming machine. In some embodiments, a Boot Server 234 contains a DHCP service that facilitates the distribution of IP addressing to the gaming machines 10. It should be noted that any device
10 capable of supporting a wagering game could be substituted for gaming machine 10. For example, a personal or laptop computer executing a wagering game may participate in the gaming network using the services described below.

As noted above, various services may be located throughout the gaming network. In some embodiments of the invention, a set of core operational services may include one or
15 more of the following services:

Boot Service	Provides dynamic IP addressing to devices upon boot (start-up). Typically supported by Dynamic Host Configuration Protocol (DHCP).
20 Discovery Service	Provides the address information of the server containing the service when prompted by the requestor as well as the service description, binding and location on the server.
Authentication Service	Contains the master Authentication Database. Authenticates the service user before allowing the use of services in the Gaming Services Framework.
25 Authorization Service	Contains the master Authorization Database. Authorizes the use of services in the Gaming Services Framework by a service requestor.
Gaming Management Service	Provides the ability to configure and monitor gaming machines and other services from a central location.
30 Name Service	Provides name resolution service to enable machines in a gaming network to refer to each other by name instead of an IP Address. In some embodiments the name service is

implemented in part using the Domain Naming System (DNS) protocol.

Time Service

Provides global synchronization of time in the gaming network. This may be implemented by running the Network Time Protocol (NTP) client software on gaming machines.

Further details on a name service according to embodiments of the invention are provided below with reference to FIGs. 5A – 5B.

In addition to or instead of the core services described above, some embodiments of the invention include one or more of the following services referred to as Basic Gaming Services:

Accounting Service

Provides logging of transaction records for billing and general tracking purposes.

Event Management Service

Logs events occurring at client and server machines.

Game Update Service

Provides dynamic distribution of new or updated game content to gaming machines.

Message Director Service

This service uses a software-configurable message routing application to facilitate the reliable exchange of data messages among multiple application processes within one or more gaming systems.

Content Integrity Service

This service provides the ability to verify the integrity of software components running in the gaming network. This includes the verification of software versions running on gaming machines, peripherals, services as well the detection of tampering or modification of the software.

As noted above, a gaming service network may include Value Add Services. These services include participation services and player services. Examples of participation services that may be included in various embodiments of the invention include the following:

Progressive Service

Provides functionality for a gaming machine to participate within a single progressive or multiple progressives. Further details on the

progressive service described above are provided below with reference to FIGs. 5A and 5B.

5 Wide Area Disruption Progressive Service This service takes over the processing of wide area progressives at each gaming site in the event that there is no connection with a central system or the connection with the central system is temporarily disabled.

10 Mobile Gaming Device GPS Service This service processes the GPS location of gaming machines compared with coordinates of a gaming jurisdiction. Example: players can ride a bus and begin gambling on the bus when the bus crosses into the gaming jurisdiction.

15 Examples of Player Services that may be included in various embodiments of the invention include:

20 Player Tracking Service This service provides the operator and player with standard player tracking applications such as monitoring card in / card out transactions to track play and award player points for play, providing targeted promotional compensation to specific players, publishing account status to the player or operator, providing temporary gaming machine locking in order to hold the machine for the player for short periods of time, and providing operators and players an interface and capability for Responsible Gaming Initiatives.

25 Game Theme Location Service This service provides location information to clients regarding specific games, game themes or vendor brands. The service may publish the information by casino, by area, by city, by state, by region, by country, or by continent depending on the input parameters provided. An example
30 would be to publish where all of the progressive games of a particular theme (e.g., "Monopoly Money") are located in a particular hotel (e.g., the Reno Hilton) in Reno, Nevada.

35 Personalization Service This service provides the gaming player with a more personalized gaming environment. Example: the player could choose to see text in Chinese, could choose to be reminded of dinner reservation time, could customize machine graphics, or could have a portion of his coin in go to his football club's progressive.

	Cashless Transaction Service	This service provides the ability for a player to transfer funds between financial institutions, in-house accounts and gaming machines.
5	Bonusing Service	This service provides the ability for casinos to set up bonus games for a specific gaming machine, carousel of machines or one or more game themes.
	Game Service	This service is a server-side process that provides the outcome of game play. This service may be used to enable Internet/ online gaming.
10	Advertising Service	This service allows the operator to display advertising information to players in multimedia format as well as simple audio and graphic formats.
15	Property Service	This is a group of services that provides the ability for the property management company to integrate with gaming systems. It can provide interaction with functions such as hotel and restaurant reservations.

It should be noted that with the distributed architecture of the Gaming Service Network 210, the above-described services that reside on network servers are not limited to location and can reside anywhere the network supports. For example, it is desirable to consider security and network latency when locating services.

FIG. 3 is a block diagram of a Gaming Services Framework 300 according to various embodiments of the invention. In some embodiments, the Gaming Services Framework 300 includes a set of protocols, XML schemas, and methods for providing gaming system functionality in a distributed, network-based architecture such as the network described above in FIG. 2. In order to participate in such network-based architectures, the participating machines are interconnected via public or private networks that may be wired or wireless networks. Further, devices performing service communication support a common services protocol stack such as the Gaming Services Protocol Stack that is further described below.

The Gaming Services Framework 300 provides for the interaction of several logical elements as depicted in FIG. 3. Logical elements represent the fundamental entities that interact to implement a service. In some embodiments, these logical elements include Service Requestor 302, Service Provider 304, and Discovery Agency 306. In general terms, the roles

these elements play are as defined in Web Services Architecture - W3C Working (Draft 14 November 2002 and later versions). Further details on these elements are provided below.

Logical elements may reside in a number of different physical devices as part of delivering any service. For example, a Service Provider 304 will typically reside in a slot accounting or player tracking system and the Service Requestor 302 will typically reside in a gaming machine. However, there may be scenarios where it would be advantageous or appropriate for the logical elements to reside in other physical devices. For example, in alternative embodiments a Service Requestor 302 may reside in a slot accounting system.

Service Provider 304 comprises a platform that hosts access to a service 314. A service provider may also be referred to as a service execution environment or a service container. Its role in the client-server message exchange patterns is that of a server.

Service Requestor 302 comprises an application that is looking for and invoking or initiating an interaction with a service such as that provided by service provider 304. Its role in the client-server message exchange patterns is that of a client 312.

Discovery Agency 306 comprises a searchable set of service descriptions where service providers 304 publish their service description(s) 324 and service location(s) 326. The service discovery agency 306 can be centralized or distributed. A discovery agency 306 can support both patterns where service descriptions 322 are sent to discovery agency 306 and patterns where the discovery agency 306 actively inspects public service providers 304 for service descriptions 322. Service requestors 302 may find services and obtain binding information (in the service descriptions 324) during development for static binding, or during execution for dynamic binding. In some embodiments, for example in statically bound service requestors, the service discovery agent may be an optional role in the framework architecture, as a service provider 304 can send the service description 322 directly to service requestor 302. Likewise, service requestors 302 can obtain a service description 324 from other sources besides a discovery agency 306, such as a local file system, FTP site, URL, or WSDL document.

FIG. 4 provides a block diagram of a Gaming Services Protocol Stack 400 according to embodiments of the invention. In some embodiments, the protocol stack includes core

layers that define basic services communication and transport, and are typically implemented uniformly. Higher layers that define strategic aspects of gaming processes are also described below. FIG. 4 illustrates both the widely implemented core layers and in addition illustrates the higher gaming services oriented layers of the protocol stack.

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Core Layers of the Gaming Services Protocol Stack 400

In some embodiments, the gaming services framework utilizes common Internet protocols, which may include web services protocols. Although not specifically tied to any transport protocol, it is desirable to build the gaming services on ubiquitous Internet
10 connectivity and infrastructure to ensure nearly universal reach and support. In some embodiments, gaming services will take advantage of Ethernet 405 or 406, Transmission Control Protocol (TCP) 408, Internet Protocol (IP) 407, User Datagram Protocol (UDP) 409, HyperText Transfer Protocol (HTTP) 410, HyperText Transfer Protocol Secure/Secure Socket Layer (HTTPS/SSL) 411, Lightweight Directory Access Protocol (LDAP) 412, Domain
15 Naming System (DNS) 413, and Dynamic Host Configuration Protocol (DHCP) 414 layers in the protocol stack 400. Those of skill in the art will appreciate that other protocol layers performing equivalent functionality may be substituted for those described above and are within the scope of the present invention.

In some embodiments, service request and response data are formatted using
20 Extensible Markup Language (XML) 415. XML 415 is a widely accepted format for exchanging data and its corresponding semantics. XML is a fundamental building block used in layers above the Common Internet Protocols. In some embodiments, the Gaming Services Protocol Stack 400 incorporates this protocol in accordance with the World Wide Web Consortium (W3C) XML Working Group's XML specification. However, those of skill in
25 the art will appreciate that other data exchange formats may be substituted for XML 415, and such formats are within the scope of the present invention.

In some embodiments of the invention, the gaming service protocol stack 400 utilizes the Simple Object Access Protocol (SOAP) 416. SOAP 416 is a protocol for messaging and RPC (Remote Procedure Call) style communication between applications. SOAP is based on

XML 415 and uses common Internet transport protocols like HTTP 410 to carry data. SOAP 416 may be used to define a model to envelope request and response messages encoded in XML 415. SOAP 416 messaging can be used to exchange any kind of XML 415 information. SOAP 416 is used in some embodiments as the basic standard for carrying service
5 requests/responses between service users and providers. SOAP 416 has been submitted to the World Wide Web Consortium (W3C) standards body as recommendation documents (versions 1.1 and 1.2) and will likely emerge as “XML Protocol (XP).”

Higher Layers of the Gaming Services Protocol Stack 400

10 In some embodiments, the gaming services protocol stack includes a Web Services Description Language (WSDL) 417 and a Universal Description, Discovery, and Integration (UDDI) 418. WSDL 417 comprises a description of how to connect to a particular service. In some embodiments, WSDL 417 is based on XML. A WSDL 417 description abstracts a particular service’s various connection and messaging protocols into a high-level bundle and
15 forms an element of the UDDI 418 directory’s information. WSDL 417 is similar to CORBA or COM IDL in that WSDL 417 describes programmatic interfaces. WSDL 417 is typically independent of the underlying service implementation language or component model, and focuses on an abstract description. The Gaming Services Protocol Stack 400 incorporates this description in accordance with the World Wide Web Consortium (W3C) Web Services
20 Description Language (WSDL) 1.1 - W3C Note 15 March 2001 and later versions.

In some embodiments, UDDI 418 represents a set of protocols and a public directory for the registration and real-time lookup of services. UDDI 418 enables an entity such as a company to publish a description of available services to the registry, thereby announcing itself as a service provider. Service users can send requests conforming to the UDDI 418
25 schema as SOAP 416 messages to the service registry to discover a provider for services. Some embodiments of the present invention may utilize UDDI Version 3, released in July of 2002 and later versions. Further development of UDDI 418 is managed under the auspices of the OASIS (Organization for the Advancement of Structured Information Standards) UDDI Specifications technical committee.

Returning to FIG. 3, the service requestors and service providers use the above-described protocol stack to perform service interactions with one another. The service interactions include publish 330, discover (find) 332, and interact 334.

Publish interaction 330 provides a mechanism for a service to be made accessible by other entities in the gaming network environment. In order to be accessible, a service needs to publish its description such that the requestor can subsequently find it. Where it is published can vary depending upon the requirements of the application. A service description 322 can be published using a variety of mechanisms known in the art. The various mechanisms used by the varying embodiments of the invention provide different capabilities depending on how dynamic the application using the service is intended to be. The service description may be published to multiple service registries using several different mechanisms. The simplest case is a direct publish. A direct publish means the service provider sends the service description directly to the service requestor. In this case the service requestor may maintain a local copy of the service description 322.

Another means of publishing service descriptions utilized in alternative embodiments of the invention is through a UDDI registry. There are several types of UDDI registries known in the art that may be used depending on the scope of the domain of Web services published to it. When publishing a Web service description to a UDDI registry, it is desirable to consider the business context and taxonomies in order for the service to be found by its potential service consumers. Examples of UDDI registries used in the gaming service architecture of various embodiments of the invention are Internal Enterprise Application UDDI registry, Portal UDDI registry, and Partner Catalog UDDI registry.

An Internal Enterprise Application UDDI registry may be used in some embodiments for gaming services intended for use within an organization for internal enterprise applications integration. For example, all services that provide gaming and gaming management to devices within a casino or casino organization may be published to an Internal Enterprise Application UDDI registry.

A Portal UDDI registry may be used in some embodiments for gaming services that are published by a company for external partners to find and use. A portal UDDI registry

typically runs in the service provider's environment outside of a firewall or in a DMZ (demilitarized zone) between firewalls. This kind of private UDDI registry generally contains only those service descriptions that a company wishes to provide to service requestors from external partners through a network. For example, these services may be used to provide
5 online gaming to customers connecting through the World-Wide Web.

A Partner Catalog UDDI registry may be used in some embodiments for gaming services to be used by a particular company. The Partner Catalog UDDI registry can be thought of as a rolodex like UDDI registry. A Partner Catalog UDDI registry is typically located on a computer or gaming machine behind a firewall. This kind of private UDDI
10 registry typically contains approved, tested, and valid service descriptions from legitimate (e.g. authorized) business partners. The business context and metadata for these services can be targeted to the specific requestor. In some embodiments, this type of registry may be used for inter-casino services as well as interactions between casinos and other types of organizations such as regulators and financial institutions. It is desirable that an appropriate
15 authorization and qualification procedure be in place to insure that only approved services are published to service repositories.

In the discover interactions 332 (also referred to as find interactions), the service requestor retrieves a service description directly or queries the registry for the type of service required. It then processes the description in order to be able to bind and invoke it.

20 As with publishing service descriptions, acquiring service descriptions may vary depending on how the service description is published and how dynamic the service application is meant to be. In some embodiments, service requestors may find Web services during two different phases of an application lifecycle - design time and run time. At design time, service requestors search for web service descriptions by the type of interface they
25 support. At run time, service requestors search for a web service based on how they communicate or qualities of service advertised.

With the direct publish approach noted above, the service requestor may cache the service description at design time for use at runtime. The service description may be statically

represented in the program logic, stored in a file, or in a simple, local service description repository.

Service requestors can retrieve a service description at design time or runtime from a Web page (URL), a service description repository, a simple service registry or a UDDI registry. The look-up mechanism typically supports a query mechanism that provides a find by type of interface capability (for example, based on a WSDL template), the binding information (i.e. protocols), properties (such as QOS parameters), the types of intermediaries required, the taxonomy of the service, business information, etc.

The various types of UDDI registries, including those described above, have implications on the number of runtime binding services can choose from, policy for choosing one among many, or the amount of pre screening that will be done by the requestor before invoking the service. Service selection can be based on binding support, historical performance, quality of service classification, proximity, or load balancing. It is desirable that an appropriate authorization and qualification procedure be in place to insure that only approved services are published to service repositories.

Once a service description is acquired, the service requestor will need to process it in order to invoke the service. In some embodiments, the service requestor uses the service description to generate SOAP requests or programming language specific proxies to the service. The generation of such requests can be done at design time or at runtime to format an invocation to the service. Various tools can be used at design time or runtime to generate programming language bindings from interface descriptions, such as WSDL documents. These bindings present an API (Application Program Interface) to the application program and encapsulate the details of the messaging from the application.

After a service has been published 330 and discovered 332, the service may be invoked so that a service requestor and service provider may interact 334. In the interact operation 334, the service requestor invokes or initiates an interaction with the service at runtime using the binding details in the service description 322 to locate, contact, and invoke the service. Examples of service interactions 334 include: single message one way, broadcast

from requester to many services, a multi message conversation, or a business process. Any of these types of interactions can be synchronous or asynchronous requests.

In some embodiments of the invention, security mechanisms may be used to secure the Gaming Services Framework 300. Securing the Gaming Services Framework typically
5 involves providing facilities for ensuring the integrity and confidentiality of the messages and for ensuring that a service acts only on requests in messages that express the claims required by policies. Examples of such mechanisms used in various embodiments of the invention include IPsec and SSL/TLS, which provide network and transport layer security between two
10 endpoints. However, when data is received and forwarded on by an intermediary beyond the transport layer both the integrity of data and any security information that flows with it maybe lost. This forces any upstream message processors to rely on the security evaluations made by previous intermediaries and to completely trust their handling of the content of messages. Thus it is desirable to include security mechanisms that provide end-to-end security. It is also desirable that such mechanisms be able to leverage both transport and application layer
15 security mechanisms to provide a comprehensive suite of security capabilities.

Name Service

In general, the various embodiments of the invention implement a name service for a gaming network. In some embodiments, a name service provides a mechanism for devices in
20 a gaming network find each other by referring to them using common names. An example of a name service incorporated in some embodiments of the invention is the Domain Name Service (DNS) that maps easy to remember URLs, such as www.yahoo.com, to an Internet address such as 66.1.10.253. Another example of a name service that may be incorporated in
25 embodiments of the invention is a file system in which a file object is referred to by a filename, such as /home/someuser/somefile.txt. Yet another example of a name service that may be incorporated in some embodiments is a distributed programming environment, such as J2EE, CORBA or .NET, which allows an application program to reference a remote object by name and make remote method calls (for example, RMI, IIOP, DCOM, .and NET Remoting) on that object.

The association of an atomic name with an object is called a binding. For example, in a file system, a filename is bound to a file in a file system. A further example is a DNS server where domain names are bound to IP addresses.

A context is an object whose state is a set of bindings with distinct atomic names. A context has an associated naming convention. A context typically provides a lookup (resolution) operation that returns an object, and may provide operations for binding names, unbinding names and listing bound names. An atomic name in one context object can be bound to another context object of the same type, called a subcontext, giving rise to compound names.

Resolution of compound names proceeds by looking up each successive atomic component in each successive context. For example in UNIX file naming, directories serve as contexts, and pathnames may be compound names, where a pathname includes a directory component and a file name component.

A naming system is a connected set of contexts of the same type (having the same naming convention) and providing the same set of operations, typically with identical semantics.

A namespace is the set of all names in a naming system.

A composite name is a name that spans multiple naming systems. It may be comprised of an ordered list of zero or more components. Each component is a name from the namespace of a single naming system. An example is the Internet URL <http://www.wmsgaming.com/public/index.html>, which is a composite name representation made up of the scheme-id http from the "URL scheme-id" namespace, www.wmsgaming.com, which is the DNS name of the machine on which the web server is running, and [public/index.html](http://www.wmsgaming.com/public/index.html), which is a file name from a file namespace. Names are interpreted relative to some context, and naming operations are performed on a context object. A client can obtain an initial context object that provides a starting point for the resolution of names.

The various embodiments of the invention implement a name service in a gaming environment that provides some or all of the functions described above and allows users,

devices and software programs in a gaming network to find each other by name without regard to the details of the underlying organization and addressing of these entities.

FIGs. 5A and 5B are flow diagrams illustrating methods for providing a name service in a gaming network according to embodiments of the invention. The methods may be performed within an operating environment such as that described above with reference to FIGs. 1-4. The methods to be performed by the operating environment constitute computer programs made up of computer-executable instructions. Describing the methods by reference to a flow diagram enables one skilled in the art to develop such programs including such instructions to carry out the methods on suitable computers (the processor of the computer executing the instructions from machine-readable media such as RAM, ROM, CD-ROM, DVD-ROM, flash memory etc.). The methods illustrated in FIGs. 5A and 5B are inclusive of the acts performed by an operating environment executing an exemplary embodiment of the invention.

FIG. 5A is a flow diagram illustrating a method for providing a name service in a service-oriented gaming network. In the detailed description of the method below, particular program method names may be provided for particular embodiments of the invention. It should be noted that such names are convenient labels for the method and are exemplary in nature. The present invention is not limited to any functionality that may be implied by the name.

The method begins instantiating a name service provider on a gaming network (block 510). The name service is typically instantiated within the operating environment and the service location is typically known ahead of time to the users of the name Service. The operating environment may be configured statically or may dynamically discover via DHCP or some other mechanism, the locations and bindings of various providers of name services such as DNS, WINS, NDS and NIS.

In some embodiments, the client/service requestor, such as a gaming machine, assumes that the name service is instantiated within the operating environment. The operating environment may comprise one or more distributed entities that work in conjunction to

provide one or more name services or components of a name service. No explicit discovery mechanism is needed.

Next, in some embodiments, a service requestor such as a gaming machine or service provider may register with the name service (block 512), although such registration is not required in any particular embodiment. A service requestor may issue one-time requests to the name service to resolve names of entities on the gaming network. Service providers may also use the name service to resolve names of clients as well as other service providers.

Finally, a client (e.g. a gaming machine, a service requestor or a service provider) can invoke the name service to process a request (block 514). In some embodiments, the following methods of the name service may be invoked:

nameServiceResolveDomainName – The client makes this call to the name service to perform a Domain Name to IP address mapping.

nameServiceResolveIPAddress – The client makes this call to the name service to perform an IP address to Domain Name mapping. This is the reverse of the previous mapping.

nameServiceResolveURL – The client makes this call to the name service to resolve a URL to an IP address/port/file system location.

nameServiceResolveFileName – The client makes this call to the name service to find the location of a file in the file system.

nameServiceResolveObjectName – The client makes this call to the Name Service to find the location of a software component/object in the system. Examples of software components may include Enterprise Java Beans, databases, directory servers, web services, etc.

FIG. 5B illustrates a method according to an embodiment of the invention for providing a name service to a client in a gaming machine network. In particular, FIG. 5B illustrates a usage scenario involving a message sequence 500. The message sequence 500 provides an example that describes how a gaming device uses the name service 502 to resolve the Domain Name of Service X 504. Message sequence 500 is but one example of a message sequence. Those of skill in the art will appreciate that other message sequences for other

types of requests are within the scope of the invention. Additional information for each message is provided below as defined by the reference number in FIG. 5B.

At 521, the Name Service 502 is deployed and becomes available, typically when the operating environment starts up.

5 At 522, a gaming machine 501 wants to contact service X 504. The gaming machine 501 knows the machine name of service X 504 (www.xxx.com), but not the IP address for the service. In some embodiments, the gaming machine 501 calls the nameServiceResolveDomainName method of the name service 502 and passes it as the machine name of service 504.

10 At 523, the name service 502 sends a query to determine the name. In some embodiments a DNS query is used. In these embodiments, the name service sends a DNS Query message to a DNS Server 503. The name service 502 has previously been configured with the IP address of the DNS server 503.

15 At 524, the DNS server 503 will consult its local database and/or neighboring DNS servers to find the result of the query.

At 525, the DNS Server 503 returns a response with the IP address mapping to the name s The Name Service 502 then returns the IP address to the Gaming Machine 501service 502.

At 526, the name service 502 then returns the IP address to the gaming machine 501.

20 At 527, the gaming machine 501 then sends a message directly to Service X 504 using its IP address).

Conclusion

25 Systems and methods providing a name service in a service-oriented gaming network environment have been disclosed. Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the

specific embodiments shown. This application is intended to cover any adaptations or variations of the present invention.

The terminology used in this application is meant to include all of these environments. It is to be understood that the above description is intended to be illustrative, and not
5 restrictive. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. Therefore, it is manifestly intended that this invention be limited only by the following claims and equivalents thereof.